



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification ⁵ : G01K 3/04, 11/06</p>	<p>A1</p>	<p>(11) International Publication Number: WO 92/08113 (43) International Publication Date: 14 May 1992 (14.05.92)</p>
<p>(21) International Application Number: PCT/GB91/01879 (22) International Filing Date: 28 October 1991 (28.10.91) (30) Priority data: 9023393 26 October 1990 (26.10.90) GB (71) Applicant (for all designated States except US): FOOD GUARDIAN LIMITED [GB/GB]; 45 Park Lane, Bewdley, Worcs. DY12 2BU (GB). (72) Inventors; and (75) Inventors/Applicants (for US only) COLLEY, Terence [GB/GB]; 45 Park Lane, Bewdley, Worcs. DY12 2EU (GB). MINTER, Stephen [GB/GB]; 16 Church Street, Hayfield, Via Stockport SK12 5JE (GB). CARNIE, John [GB/GB]; 2 Cambo Walk, Heaton Mersey, Stockport SK4 3KT (GB).</p>		<p>(74) Agent: ATKINSON, Peter, Birch; Marks & Clerk, Suite 301, Sunlight House, Quay Street, Manchester M3 3JY (GB). (81) Designated States: AT, AT (European patent), AU, BB, BE (European patent), BF (OAPI patent), BG, BI (OAPI patent), BR, CA, CF (OAPI patent), CG (OAPI patent), CH, CH (European patent), CI (OAPI patent), CM (OAPI patent), CS, DE, DE (European patent), DK, DK (European patent), ES, ES (European patent), FI, FR (European patent), GA (OAPI patent), GB, GB (European patent), GN (OAPI patent), GR (European patent), HU, IT (European patent), JP, KP, KR, LK, LU, LU (European patent), MC, MG, ML (OAPI patent), MN, MR (OAPI patent), MW, NL, NL (European patent), NO, PL, RO, SD, SE, SE (European patent), SN (OAPI patent), SU*, TD (OAPI patent), TG (OAPI patent), US. Published <i>With international search report.</i></p>
<p>(54) Title: MARKING ELEMENT</p> <div data-bbox="535 1113 1023 1785"> </div> <p>(57) Abstract</p> <p>A marking element for indicating whether a pre-defined temperature condition has been maintained. The marking element (1) comprises a first material (8) capable of flowing above a pre-determined temperature separated from a second absorbent material (6) by a barrier layer (7). The first and second materials are such that when the barrier layer (7) is punctured and the pre-determined temperature is exceeded the first material (8) flows along the second material (6) to produce a detectable change.</p>		

+ DESIGNATIONS OF "SU"

Any designation of "SU" has effect in the Russian Federation. It is not yet known whether any such designation has effect in other States of the former Soviet Union.

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MARKING ELEMENT

The present invention relates to a marking element for use in conjunction with a product which is required to be maintained under a particular temperature or temperature-time condition.

There are many products which need to be stored under conditions such that a particular temperature limit is not exceeded, or at least is not exceeded for longer than a predetermined time. For convenience, both of these conditions are referred to generically herein as the pre-defined temperature condition. Generally the temperature limit will be a maximum (rather than a minimum) temperature.

Particular examples are certain types of food product that have been pre-cooked or processed by freezing, irradiation, partial cooking, freeze drying or steaming (or other food processing procedures). If such products are not stored in accordance with the pre-defined temperature conditions then there is the danger of contamination by organisms which are injurious to human health. This danger is not removed by subsequently storing the product below the temperature maximum. Further examples of products which may need to be stored in accordance with pre-defined temperature conditions are certain pharmaceuticals which would otherwise deteriorate.

Currently, the purchasers of such susceptible products are not able to determine whether the product has been stored in contravention of the pre-defined conditions. For example, frozen food purchased in, say, a supermarket may be adequately frozen at the time of sale but the purchaser is unable to tell whether the food has previously been incorrectly stored. This has the potential health disadvantages mentioned above.

According to a first aspect of the present invention there is provided a marking element for indicating whether a pre-defined temperature condition has been maintained,

comprising a first material capable of flowing above a predetermined temperature separated from a second absorbent material by a barrier layer (preferably impervious), the first and second materials being such that when the barrier layer is punctured and the predetermined temperature is exceeded the first material flows along the second material to produce a detectable change.

Preferably the marking element is constructed such that the first flowable material is provided adjacent one end of an elongate channel and (at that end of the channel) is separated by said barrier layer from the absorbent material which extends along the channel. Thus when the barrier layer has been punctured and the predetermined temperature has been exceeded the first material flows along the channel producing said detectable change. The extent to which the first material flows along the channel (and this extent of the detectable change along the channel) is an indication of the total time at which the marking element has been above the predetermined temperature.

A particularly suitable way of producing the marking element as described in the previous paragraph is to print a layer of an ink on to a carrier sheet such that the channel is formed in the ink. The absorbent material may be laid in position along the channel and then overlaid by a film providing the barrier layer. The first material may then be provided in the region of the barrier layer above the absorbent material and the whole then overlaid by a further film having a melting point higher than that of the barrier layer. In this way it is possible to use a probe heater to a temperature above the melting point of the barrier layer but below that of the outer film layer whereby the barrier layer is selectively punctured to "activate" the label.

Ideally the elongate channel is formed at one end with an enlarged "reservoir" region in which the first material is received.

Preferably the detectable change is a colour change so that any flow of the first material as a result of the predetermined temperature being exceeded is immediately visible.

The first material may comprise a polymeric material which reversibly fuses above a desired temperature, e.g. a thermo-reversible wax. It will of course be appreciated that the material to be used will be selected having regard to the desired temperature of fusion, and that for any one type of polymeric material it is possible to have a range of fusion temperatures depending on the molecular weight of the material. Inorganic salts (e.g. sodium or potassium chloride) can also be incorporated in the polymeric material for providing variation in temperature of fusion.

The absorbent material may for example be paper or a particulate material (e.g. kieselguhr).

The detectable change may be produced in a number of ways. For example, the first material may include a dye which (during flow of the first material) causes the absorbent material to become dyed and therefore coloured. Alternatively, the detectable change may be a colour change resulting from an irreversible chemical reaction. Thus the first and second materials may incorporate respective chemical reagents which when in contact react together to produce a colour change.

According to a second aspect of the present invention there is provided a marking element for indicating whether a pre-defined temperature condition has been maintained, the marking element comprising an elongate indicator track along which a detectable change (preferably a colour change) occurs when the marking element is above a predetermined temperature, the length of the change being representative of the time for which the marking element is above said pre-determined temperature.

Preferably the marking element comprises a carrier layer on one face of which is laid a coating in which the indicator track is provided. To this end, the indicator

track may include an absorbent material along which a colour is developed, as described for the first aspect of the invention. The reverse side of the carrier layer may be adhesively coated for fixing the marking element to a product for which the temperature storage conditions are to be monitored.

The invention will be further described by way of example only with reference to the accompanying drawings, in which:

Fig. 1 is an exploded perspective view of one embodiment of label in accordance with the invention; and

Fig. 2 shows the label after storage above the permitted temperature.

The construction of the label 1 will be described by reference to its method of production.

A carrier sheet 2 (which is adhesively coated on its reverse face) is printed with an ink layer 3 (e.g. a polymer based ink) which is such that a layer 3 of predetermined thickness is laid down. Layer 3 is shown as being generally rectangular but does include a circular aperture 4 adjacent to one end of a longitudinally extending rectangular channel 5. A plurality of rectangular ink layers 3 may be printed on to the carrier sheet 2. The layer 3 may, for example be white.

An absorbent paper wick 6 is then laid completely along the length of channel 5, the wick 6 being of sufficient length so as to extend over into the aperture 4 where the wick terminates (see inset to drawing). Instead of a paper wick it is possible to use a powder wick, e.g. of kieselguhr. Furthermore, although Fig. 1 shows the channel 5 opening into aperture 4, it is possible for there to be a barrier of the ink 3 between the end of channel 5 and the aperture 4. In such a case, the wick 6 may simply extend over the barrier.

In the next stage of manufacture, a clear layer 7 of a heat shrink film is laminated on to the ink layer 3. for convenience, the drawing shows layer 7 as being coterminous

with layer 3 but in practice a single layer 7 may be provided to overlie all of the layers 3.

An amount of a temperature condition indicator material 8 is then introduced into aperture 4 and "sits" on the layer 7 above the wick 6. This material is one which is of a viscosity such that the material does not flow (at least to any substantial extent) below a predetermined temperature, but will be capable of flowing along the wick 6 above this temperature. The predetermined temperature is the temperature above which a product (with which the finished label will be associated) should not be stored, or at least not stored above the temperature for more than a predetermined time.

The material 8 will generally be coloured, e.g. by the incorporation of a dye therein. A red dye is particularly suitable for use in conjunction with a white layer 3.

In the final stage of manufacture, a further clear layer 9 is applied. This layer 9 may of course be a single layer overlying all of the layers 3.

Layer 9 is of a material which melts (or softens) only at a higher temperature than does layer 7. This latter layer may for example be one which melts or softens at 100 to 120°C. Furthermore, layer 9 may be printed with indicia, such as the scale 10 and other information e.g. company name (not shown).

In use, the label is attached to the packaging of a product whose storage temperature is to be monitored. The label is then activated by the application of a point source of heat. This can be achieved by using a flat pointed probe of 2-2.5 mm in diameter heated to at least 100°C but no higher than 120°C (a hand held soldering iron will suffice if it can be controlled to the desired temperature). The flat pointed probe is applied within the circular area of the label and should be held in position for 0.5-1 mseconds. As a result, layer 7 is punctured so that material 8 is able to come into contact with the wick 6.

Once activated, the label must be maintained below the specified storage temperature for the product.

If the temperature at which the product is stored rises above the predetermined temperature then the material 8 will become less viscous and will be capable of flowing along the wick 6. The material 8 will continue to flow along the wick for so long as the predetermined temperature is exceeded. This will result in the wick becoming indelibly coloured over a part of its length extending from its end adjacent aperture 4 (see Fig. 2). It will be appreciated that in the event of the product being stored above the permitted temperature and then returned to below the permitted temperature, the material 8 increases in viscosity to prevent movement along the wick 6 although the indelible colouring of the wick 6 is maintained. If the product should then once again be stored above the permitted temperature, the viscosity of material 8 will decrease and the material can advance further along the wick.

A measure of the length of time for which the temperature has been exceeded may be obtained by reference to the scale 10, the graduations of which may be representative of the number of minutes exposure above the predetermined time. It is obviously an easy matter to inspect the scale visually to obtain a representation of the total time that the product has been stored above the predetermined temperature. If this time is excessive then the product may be discarded.

It should be appreciated that the labels 1 may be used in a number of ways. For example, the label may be attached to the packaging of individual products so that a purchaser of the product (e.g. in a supermarket) can determine the time for which the product has been stored above the permitted temperature. Alternatively, a label may be attached to a carton in which the products are delivered to (say) a supermarket. In this case, the supermarket personnel are able to decide whether the

product has been stored above the permitted temperature for too long.

The marking element according to the invention may also take a number of forms other than that illustrated in the accompanying drawings.

For example, the marking element may comprise a backing paper, a paper strip forming a wick which is positioned on the backing paper, a heat sensitive laminate applied over the backing paper and paper strip, a paper pad positioned over one end of the paper strip and containing the indicator material, and a final laminate to seal the system.

Furthermore, it is not essential that the marking element be used as an indicator of the time for which the product has been stored above a particular temperature. The marking element may be used, for example, merely to indicate that a particular storage temperature has been exceeded. For example, the marking element may comprise a circular paper pad (fixed to a support) overlaid by a heat-sensitive polymer layer between which an upper laminate layer is sandwiched to the indicator material. To use the marking element, the heat sensitive polymer layer is punctured as described above. If the marking element is subjected to a temperature above that at which the indicator material will flow, then this material flows into the paper pad and provides an indication that a predetermined temperature has been exceeded.

CLAIMS

1. A marking element for indicating whether a pre-defined temperature condition has been maintained, comprising a first material capable of flowing above a predetermined temperature separated from a second absorbent material by a barrier layer, the first and second materials being such that when the barrier layer is punctured and the predetermined temperature is exceeded the first material flows along the second material to produce a detectable change.
2. A marking element as claimed in claim 1, wherein the barrier layer is impervious.
3. A marking element as claimed in claim 1 or claim 2, wherein the first flowable material is provided adjacent one end of an elongate channel and at the said end of the elongate channel is separated by said barrier layer from the absorbent material which extends along the channel.
4. A marking element as claimed in claim 3, wherein the elongate channel is formed at one end with an enlarged region to provide a reservoir in which the first material is received.
5. A marking element as claimed in any preceding claim, wherein the detectable change is a colour change.
6. A marking element as claimed in any preceding claim, wherein the first material comprises a polymeric material which reversibly fuses above a desired temperature.
7. A marking element as claimed in claim 6, wherein the polymeric material is a thermo-reversible wax.
8. A marking element as claimed in claim 7, wherein the polymeric material incorporates an inorganic salt to provide a modification of its temperature of fusion.
9. A marking element as claimed in any preceding claim, wherein the absorbent material is paper.
10. A marking element as claimed in any one of claims 1 to 8, wherein the absorbent material is a particulate material.
11. A marking element as claimed in any preceding claim

wherein the first material includes a dye which during flow of the first material produces the detectable change in the absorbent material.

12. A marking element as claimed in any one of claims 1 to 10, wherein the detectable change is a colour change resulting from an irreversible chemical reaction.

13. A marking element as claimed in any preceding claim incorporating an outer film layer overlying the first material, the outer film layer having a melting point higher than the melting point of the barrier layer.

14. A method of producing of a marking element as claimed in claim 3 comprising printing a layer of ink on to a carrier sheet such that the channel is formed in the ink, providing the absorbent material along the channel, and then overlying the absorbent material with a film providing the barrier layer.

15. A method as claimed in claim 14, wherein the first material is provided in the region of the barrier layer above the absorbent material and the whole is then overlaid by a further film having a melting point higher than that of the barrier layer.

16. A marking element for indicating whether a pre-defined temperature condition has been maintained, the marking element comprising an elongate indicator track along which a detectable change occurs when the marking element is above a pre-determined temperature, the length of the change being representative of the time for which the marking element is above said pre-determined temperature.

17. A marking element as claimed in claim 16, wherein the marking element comprises a carrier layer on one face of which is laid a coating in which the indicator track is provided.

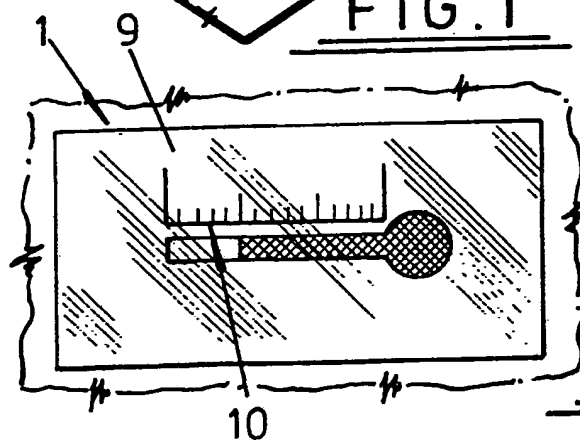
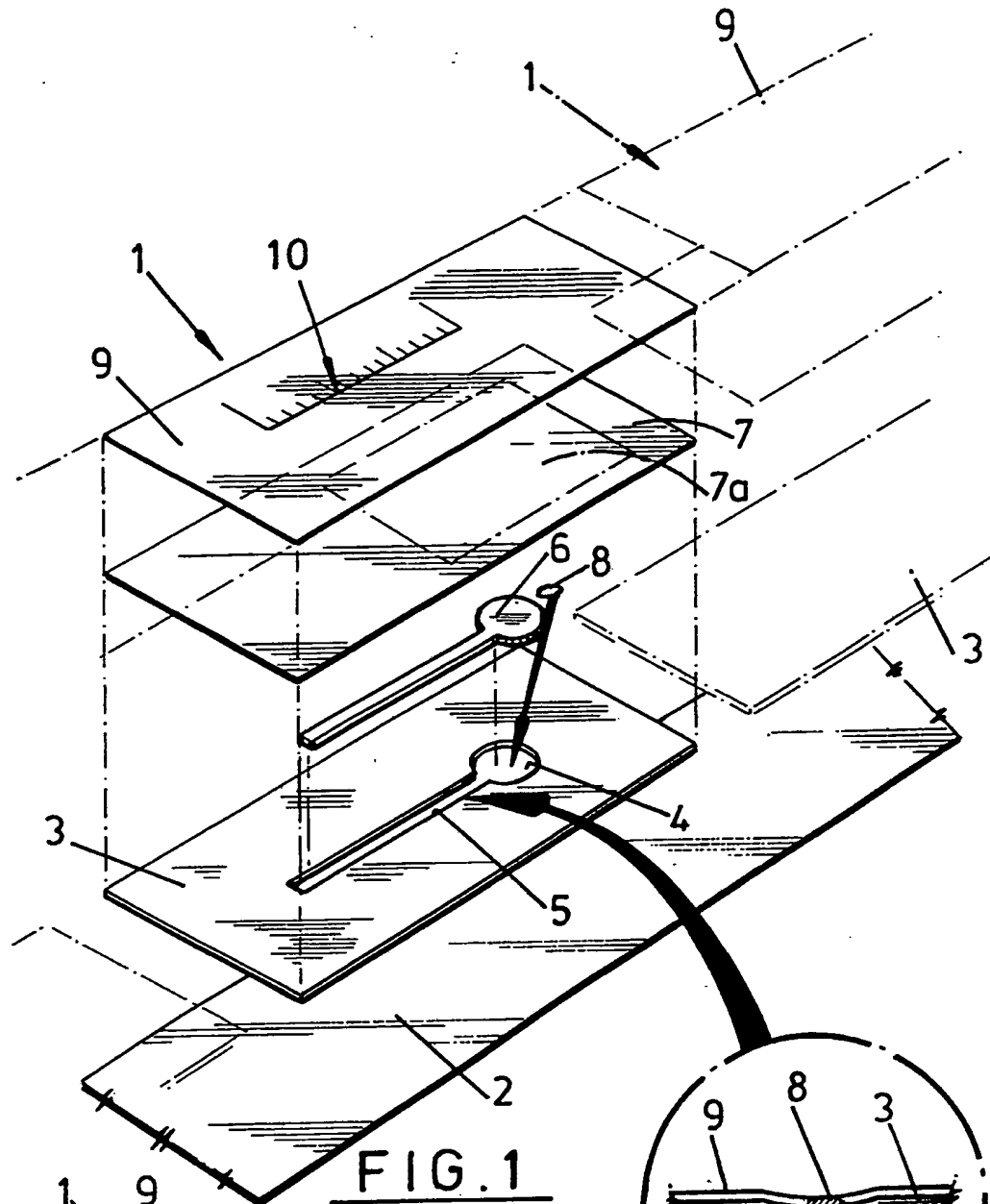
18. A marking element as claimed in claim 17, wherein the indicator track includes an absorbent material along which a colour is developed.

19. A marking element as claimed in claim 18, wherein the colour is developed due to a flowable material including a

dye flowing along the absorbent material, causing the absorbent material to become dyed.

20. A marking element as claimed in claim 18, wherein the colour developed results from an irreversible chemical reaction.


21. A marking element as claimed in any one of claims 17 to 20, wherein a reverse side of the carrier layer is adhesively coated for fixing the marking element to a product for which the temperature storage conditions are to be monitored.



INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 91/01879

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) ⁶		
According to International Patent Classification (IPC) or to both National Classification and IPC		
Int.Cl. 5 G01K3/04; G01K11/06		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
Int.Cl. 5	G01K	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸		
III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹		
Category ¹⁰	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claims No. ¹³
P,X	WO,A,9 109 287 (TEPNEL MEDICAL LTD.) 27 June 1991 see the whole document	1-21
Y	US,A,3 055 759 (J.C. BUSBY E.A.) 25 September 1962	1
A	see the whole document	2-10
Y	US,A,3 420 205 (A.MORISON) 7 January 1969	1
A	see column 16, line 47 - column 17, line 3; figures	2-21
Y	EP,A,0 092 034 (P.H.LIST E.A.) 26 October 1983	1
A	see page 11, line 20 - page 14, line 12; figures 1-5	2-21
A	US,A,4 647 224 (HOLM) 3 March 1987 see column 4, line 30 - column 4, line 68	1,4,6,7, 16
-/-		
<p>¹⁰ Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"A" document member of the same patent family</p>		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
1 FEBRUARY 1992	27.02.92	
International Searching Authority	Signature of Authorized Officer	
EUROPEAN PATENT OFFICE	RAMBOER P. 	

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
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A	US,A,3 751 382 (S.L. LUNGBERG E.A.) 7 August 1973 see the whole document	1
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**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO. GB 9101879
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Page 2

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